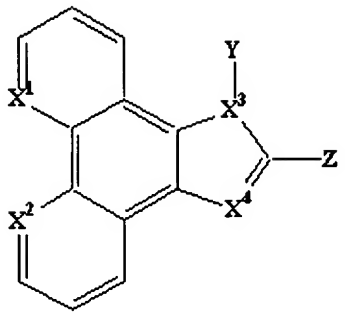
WE CLAIM:

1. A compound having a formula (1)



(1)

where X^1, X^2, X^3 and X^4 are each independently selected from the group consisting of carbon and nitrogen;

Y is selected from the group consisting of hydrogen, a substituted or unsubstituted aryl group, and a substituted or unsubstituted aliphatic group having 1-24 carbon atoms which may be straight, branched or cyclic;

Z is a substituted or unsubstituted aryl moiety selected from the group consisting of phenyl, biphenyl, naphthyl, anthryl, phenanthryl, pyrenyl, pyridyl, bipyridyl, indyl, and quinolinyl; and

wherein a said substituent is selected from the group consisting of an aryl group, an alkoxy group, a hydroxy group, a halo group, an amino group, a nitro group, a nitrile group, $-CF_3$ and an aliphatic group having 1-24 carbon atoms which may be straight, branched or cyclic.

2. A compound as claimed in claim 1 wherein said compound is photoluminescent or electroluminescent.

3. A compound as claimed in claim 1 wherein X^1, X^2, X^3 and X^4 are independently selected from the group consisting of a substituted carbon, an unsubstituted carbon and an unsubstituted nitrogen.

4. A compound as claimed in claim 1, wherein at least one of X^1, X^2, X^3 and X^4 is nitrogen.

5. A compound as claimed in claim 1 wherein X^1, X^2, X^3 and X^4 are nitrogen.

6. A compound as claimed in claim 1 wherein Y is an aliphatic group having 1-12 carbon atoms.

7. A compound as claimed in claim 1 wherein Y is an aliphatic group having 1-4 carbon atoms.

8. A method of synthesizing a compound as claimed in claim 1 comprising at least one step selected from the group consisting of:

$$Phen(NH_2)_2 + ZCOOH \rightarrow PhenImZ$$

and $$PhenImZ + NaH + YI \rightarrow YPhenImZ$$

wherein Y is selected from the group consisting of hydrogen, substituted or unsubstituted aryl group, and substituted or unsubstituted aliphatic group having 1-24 carbon atoms which may be straight, branched or cyclic;

Z is selected from the group consisting of phenyl, biphenyl, naphthyl, anthryl, phenanthryl, pyrenyl,, pyridyl, bipyridyl, indyl, and quinolinyl; and

wherein a said substituent is selected from the group consisting of an aryl group, an alkoxy group, a hydroxy group, a halo group, an amino group, a nitro group, a nitrile group, $-CF_3$ and an aliphatic group having 1-24 carbon atoms which may be straight, branched or cyclic.

9. A method of synthesizing a compound as claimed in claim 1 comprising at least one step selected from the group consisting of:

$$PhenO_2 + ZCHO \rightarrow PhenImZ$$

and $$PhenImZ + NaH + YI \rightarrow YPhenImZ$$

wherein Y is selected from the group consisting of hydrogen, substituted or unsubstituted aryl group, and substituted or unsubstituted aliphatic group having 1-24 carbon atoms which may be straight, branched or cyclic;

Z is selected from the group consisting of phenyl, biphenyl, naphthyl, anthryl, phenanthryl, and pyrenyl; and

wherein a said substituent is selected from the group consisting of an aryl group, an alkoxy group, a hydroxy group, a halo group, an amino group, a nitro group, a nitrile group, $-CF_3$ and an aliphatic group having 1-24 carbon atoms which may be straight, branched or cyclic.

10. A photoluminescent or electroluminescent compound having a formula selected from the group consisting of PhenImAn (2), MePhenImAn (3), PhenImPy (4), and MePhenImPy (5).

11. A composition comprising a compound as claimed in claim 1, an organic polymer and a solvent.

12. A composition comprising a photoluminescent or electroluminescent compound as claimed in claim 2, an organic polymer and a solvent.

13. A photoluminescent product or an electroluminescent product comprising a compound as claimed in claim 2 or claim 10.

14. The product of claim 13 which is a flat panel display device.

15. The product of claim 13 which is a luminescent probe.

16. A method of producing electroluminescence, comprising the steps of: providing an electroluminescent compound as claimed in claim 2 or claim 10 and applying a voltage across said compound so that said compound electroluminesces.

17. An electroluminescent device for use with an applied voltage, comprising:
a first electrode,
an emitter which is an electroluminescent compound as claimed in claim 2 or claim 10, and
a second, transparent electrode,
wherein voltage is applied to the two electrodes to produce an electric field across the emitter so that the emitter electroluminesces.

18. An electroluminescent device for use with an applied voltage, comprising:
a first electrode,
a second, transparent electrode,
an electron transport layer adjacent the first electrode,
a hole transport layer adjacent the second electrode, and
an emitter which is an electroluminescent compound as claimed in claim 2 or claim 10 interposed between the electron transport layer and the hole transport layer,
wherein voltage is applied to the two electrodes to produce an electric field across the emitter so that the emitter electroluminesces.

19. 2-(9-anthryl)imidazo[4,5-f]-[1,10]phenanthroline (2).

20. 1-methyl-2-(9-anthryl)imidazo[4,5-f]-[1,10]phenanthroline (3).

21. 2-(2-pyridyl)imidazo[4,5-f]-[1,10]phenanthroline (4).

22. 1-methyl-2-(2-pyridyl)imidazo[4,5-f]-[1,10]phenanthroline (5).

23. A method of detecting metal ions comprising the steps of: providing a photoluminescent compound as claimed in claim 2, and detecting photoluminescence of said compound, wherein contact with a metal ion quenches said photoluminescence of said compound.

24. The method of claim 19 wherein said metal ions are selected from the group consisting of Zn^{2+}, Cu^{2+}, Ni^{2+}, Cd^{2+}, Hg^{2+} and Ag^{+}.

25. A method of detecting acid comprising the steps of: providing a photoluminescent compound as claimed in claim 2, and detecting photoluminescence of said compound, wherein protonation of said compound changes the state of said compound's photoluminescence.

26. A method of harvesting photons comprising the steps of: providing a compound as claimed in claim 1, and providing light such that photons strike said compound and charge separation occurs in said compound.

27. The method of claim 26 wherein said separated charges recombine and photons are released.

28. The method of claim 26 wherein said separated charges migrate to respective electrodes to produce a potential difference.

29. A method of separating charges comprising the steps of: providing a compound as claimed in claim 1 and providing light such that photons strike said compound and charge separation occurs in said compound.

30. The method of claim 29 wherein said separated charges recombine and photons are

released.

31. The method of claim 29 wherein said separated charges migrate to respective electrodes to produce a potential difference.

32. A photocopier employing the method of claim 26 or 29.

33. A photovoltaic device employing the method of claim 26 or 29.

34. A photoreceptor employing the method of claim 26 or 29.

35. A solar cell employing the method of claim 26 or 29.

36. A semiconductor employing the method of claim 26 or 29.

37. A molecular switch comprising a compound as claimed in claim 2 that is capable of existing in more than one luminescent state, wherein acid, base, and/or incident light produces a change in the luminescent state of said compound.

38. The molecular switch of claim 37 wherein said compound is 2-(9-anthryl)imidazo[4,5-f]-[1,10]phenanthroline (2) or 2-(2-pyridyl)imidazo[4,5-f]-[1,10]phenanthroline (4).

39. A circuit comprising a molecular switch as claimed in claim 37 or 38.